Biomass Other

Opportunities to develop vegetative biomass as an energy resource exist in many arenas. Residues from wood and agricultural crops can be used in a variety of energy applications — ranging from direct combustion and gasification to ethanol production and anaerobic digestion. In addition, soybeans and other vegetables can replace petroleum-derived products such as lubricants used for everything from hydraulic fluid to railroad grease. The following pages briefly address Iowa's efforts and activities in these areas.

Corn Stover And Other Crop Residues

The energy potential from corn does not end with the kernel. Corncobs, stalks and leaves — known as corn stover — are also being developed as biomass resources. Although corn stover has no food value, it holds significant promise as a feedstock for energy production. Crop residues from soybeans and wheat can also be used as energy feedstocks, but removal of these residues is not recommended in Iowa in order to limit soil erosion.[1]

As much as 150 million dry tons of crop residues, including 120 million tons of corn stover, are available each year in the United States.[2] Corn stover represents Iowa's largest biomass resource, as 21 million tons of corn stover could be available for energy applications on an annual basis.[3] This amount of corn stover possesses an energy value of 325 trillion BTU per year, or the amount of energy needed to satisfy the heating and electricity requirements of more than 3.3 million homes annually.[4]

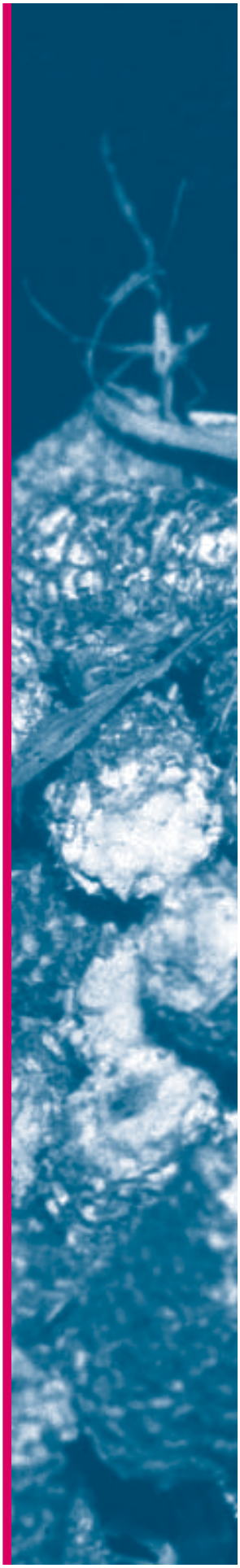
Farmers employing no-till farming practices can harvest significant quantities of stover on land with less than a 3-percent slope without depriving the soil of essential nutrients or increasing the risk of soil erosion.[5] Removing a portion of crop residues can also lower tillage requirements, reduce planting difficulties, improve germination, and limit pest and weed problems in a no-till environment. Farmers who do not currently practice conservation tillage may be encouraged to do so as market potential for corn stover expands.[5]

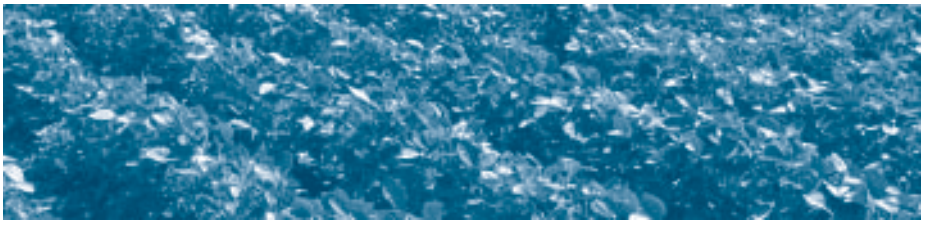
The principal barrier to using corn stover and other residues for energy production is cost. Researchers are developing powerful enzymes that can help convert crop residues into ethanol, but these enzymes are expensive. With improved technologies and an increase in the number of manufacturers, ethanol production from crop residues could become commercially viable.[6] Iowa State University also is conducting research on gasification of corn stover and other biomass for energy production. The Union of Concerned Scientists has estimated that the production and delivery costs associated with crop residues are greater than those associated with dedicated biomass crops.[7]

One example of corn stover development is occurring in Harlan, Iowa. BioMass Agri-Products (B/MAP), a producer-owned company, formed after a 1999 feasibility study showed the economic viability of converting feedstocks such as corn stover into transportation fuel, fiber and other chemical products. B/MAP is working with partners to develop reliable and consistent harvesting, transportation and storage techniques, along with performing research and development studies to find other potential corn stover markets. The National Renewable Energy Laboratory (NREL) awarded an $80,000 contract to B/MAP to supply corn stover for NREL's cellulose-to-ethanol plant. B/MAP has purchased more than 20,000 tons of corn stover from Iowa farmers between 2000 and 2001 at a $20-per-acre profit to farmers.[8]

Wood Residues

During fiscal year 1998, more than 150,000 tons of wood residues were disposed of in Iowa landfills — not including the wooden construction and demolition waste taken to landfills during the same period. Wood residues represented about 7 percent of solid waste landfilled in the state.[9] Used





pallets, crates and other wood packaging likely make up a large portion of wood waste that reaches the landfill. Yard waste has been banned from landfills since 1991, and many wood processors sell their wood by-products for landscaping mulch, compost or livestock bedding.[10]

A number of industries use wood residues to generate heat or electricity for their operations. Many sawmills, for instance, use wood-fired boilers to dry lumber. According to a 1995 study by M. L. Smith Environmental, Inc., wood residue as an industrial fuel is feasible and profitable in 30 industrial boilers in Iowa's nine largest counties. Existing boilers could be converted into partial wood burners, allowing industries to save money by reducing their purchases of coal for boiler fuel. Currently in Iowa, more than 44,000 tons of wood residues are used for heat or electricity production annually.[11]

Wieland & Sons Lumber Company in Winthrop, Iowa, is one example of a business that has switched from selling its wood residue to using it on-site as an energy source. Dean Wieland, the owner of Wieland & Sons, installed a 600-horsepower, high pressure steam boiler system to be fueled with wood residue from his operation. Before building the facility, Wieland sold wood waste to a Fort Madison paper plant or to farmers for livestock bedding. The company prefers using residue for on-site energy generation because it is less complicated and more profitable. A portion of the funds used to purchase the boiler came from the Iowa Energy Center's Alternate Energy Revolving Loan Program.[12]

Lubricants

Scientists at the University of Northern Iowa (UNI) Ag-Based Industrial Lubricants (ABIL) Research Program are developing diesel fuels and lubricants from the same kinds of vegetable oils used in kitchens. These oils, made from sources such as soybeans, corn, and canola, perform better and pollute less than petroleum counterparts.[13]

In standardized tests, vegetable oils have been shown to be significantly more biodegradable than petroleum-based products.[14] Vegetable-based lubricants also have superior lubricity, a higher flash point, and lower toxicity than petroleum-based products.[15] Replacement hydraulic fluids biodegrade into environmentally benign components once introduced into water and soil. Should limited spills and leaks occur, they will not create environmental hazards.[16]

Vegetable-based lubricants are gaining worldwide support. In Germany's Black Forest region, environmental protection laws require farm machinery to use only biodegradable fuels and lubricants.[17]

In 1998, the State of Iowa established a law requiring state agencies to give preference to biodegradable crop oils in government vehicles and equipment, when budgets allow (Iowa Code 18.22).[18] The new law provides introductory market support for the demonstration of seed oils.[19]

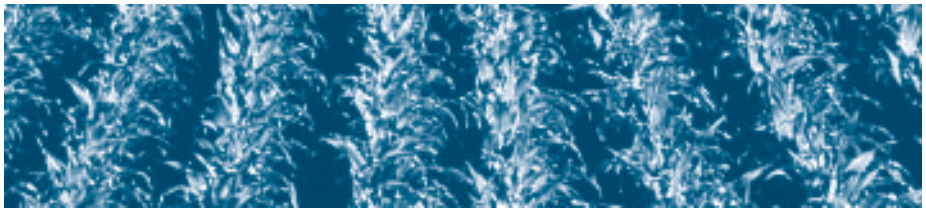
UNI's ABIL Research Program commercially introduced a multi-grade hydraulic fluid called BioSOY. The vegetable oil replaces hydraulic fluid in heavy machinery and has set a precedent for the use of soybean oil in industrial lubricants.[20]

Another of ABIL's products, SoyTRUK, is a soy-based lubricant used to ease friction between semi-tractors and their loaded trailers. Additionally, SoyTRAK is an ABIL-developed grease that can be applied to railroad tracks to reduce friction between the train's wheels and the rails. Friction creates drag, reducing fuel efficiency. By using lubricants, fuel efficiency increases by between 7 and 17 percent, while equipment wear decreases. The grease was tested on about 300 miles of Iowa's railroad track owned by Iowa Interstate Railroad, Ltd. Used as a replacement for conventional petroleum-based products, Soy TRAK minimizes environmental threats associated with seepage of grease into water and soil.[21]

Waverly Light and Power and ABIL have received six U.S. patents for "BioTrans," a soy-based oil to be used in standard-distribution-system transformers.[22] The national market potential for this product is enormous — the United States has about 4.5 billion gallons of the petroleum-based transformer oil in use today.

Animal Fats

Swift and Company of Marshalltown and National By-Products of Des Moines and Clinton are burning rendered animal fats in their boilers and saving money in the process. Savings of $15,000 to $25,000 per month are possible, compared to natural gas and fuel oil prices. Rendered animal fats do not require further processing to be used as fuel sources so switching can be accomplished at little cost with a quick payback. Rendered animal fats burn almost as cleanly as natural gas and at approximately the same BTU value of fuel oils. National By-Products has cut air emissions by half compared to those generated from petroleum fuel.[23]



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